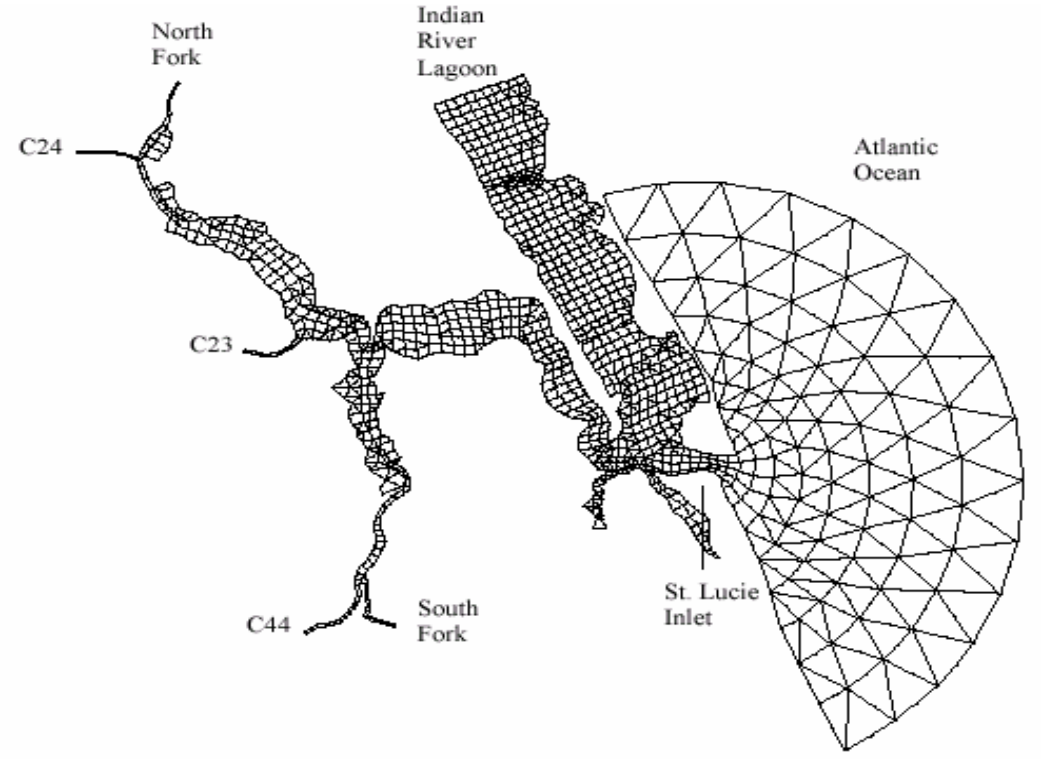

Figure 6-7. Boundary Domain of the St. Lucie Estuary Model

The Waterways Experiment Station (WES) of the USACE is converting the existing St. Lucie hydrodynamics/salinity model to a three dimensional version. The new version will be able to simulate salinity and temperature stratification and the formation and movement of a salt wedge. Both phenomena have been observed and recorded in the field. WES is also extending the model to cover the Indian River Lagoon between Fort Pierce and Jupiter Inlets (including the Loxahatchee River). Model development is anticipated to be completed by 2003.

Water Quality Modeling

The SFWMD initiated a project in 1999 to model watershed water quality. Under a contract with the SFWMD, URS Corporation developed a watershed hydrology and water quality model (WaSh) suitable for assessing some of the unique hydrologic issues in South Florida involving dense drainage canal systems, high water tables, and multiple irrigation sources and for evaluating watershed management options. The model has a cell-based representation of watershed surface where hydrology and water qualities are modeled with Hydrologic Systems Program Fortran (HSPF). The infiltrated water is routed to a groundwater model that represents the surficial aquifer of simulated watersheds. The runoff is routed to a drainage system model that has the capacity to simulate bi-directional flow, branches, and common flow structures. An Arcview Graphic User Interface (GUI) has also been developed to facilitate BMP implementation, land use changes, reservoir and stormwater treatment system operations that are key watershed management strategies in South Florida

The ultimate goal of the water quality modeling effort is to develop watershed management strategies to achieve PLRGs (Pollution Load Reduction Goals) for the South IRL watershed. To better meet this goal, the District initiated a 3 dimensional (3-D) estuary water quality modeling

project for SLE/IRL in 2001. A 3-D water quality model, namely the Environmental Fluid Dynamic Code (EFDC), is being developed, calibrated, validated, and applied to simulate estuarine hydrodynamics, salinity stratification and distribution, bed erosion and sedimentation, and water quality behavior in the SLE using existing data. Curvilinear-orthogonal model grid cells are generated to represent the St. Lucie Estuary, the down stream of North Fork and South Fork, and the lower portion of the Indian River Lagoon (see Figure 6-8). The model grid has sufficiently high resolution to incorporate essential bathymetry while maintaining computational efficiency needed to perform long-term simulations. Model calibration and validation are being conducted in a step-by-step fashion following the sequence of hydrodynamic/salinity modeling, sediment modeling, and water quality modeling. Calibration and validation of the hydrodynamic/ salinity model, sediment model, and water quality model are scheduled to be complete in 2003. All of parameters listed in Table 6-5 could be addressed through the use of the Watershed and Estuary models. Basin loads can be calculated, as well as distribution within receiving water bodies Site specific allocation of parameters may not be possible without further understanding of receiving water body processes and dynamics. In order to evaluate the effectiveness of pollutant reduction strategies, the remaining modeling efforts shall include predicting estuarine water quality parameters as a function of external inputs, internal hydrodynamics, relevant processes, and transformations occurring in the estuary.

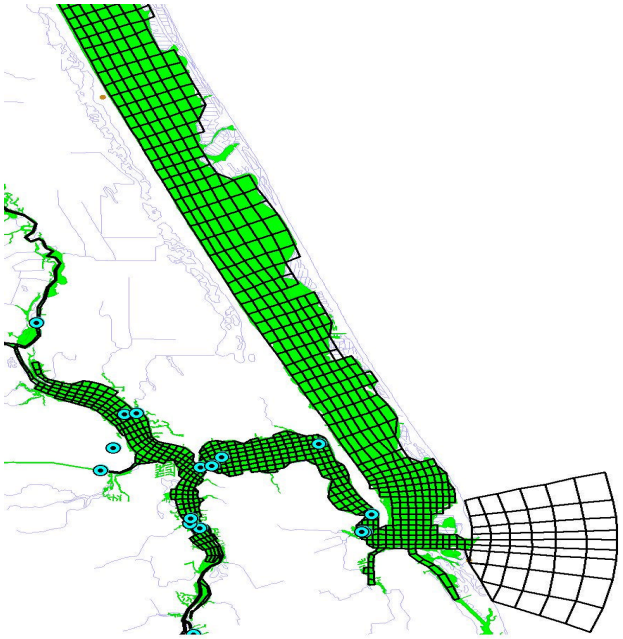

Figure 6-8. Grid Structure of the Environmental Fluid Dynamic Code Water Quality Model

Applied Studies

A variety of organizations have monitoring and research underway in the South IRL and it's watershed. The SFWMD, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), Florida Fish and Wildlife Conservation Commission (FFWCC), Harbor Branch Oceanographic Institute (HBOI), Smithsonian Marine station, (National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey (USGS), and others have on-going studies. In addition, partnership studies have been performed with several Non-Governmental Organizations (NGOs). The SFWMD has developed an Estuary Research Plan, (Coastal Ecosystems Division, August 2001), that outlines strategies for monitoring, modeling,

and research. The Research Plan outlines projects that are intended to provide decision-makers with the scientific information necessary to attain management objectives. The research projects described are either ongoing or planned to begin within the next two or three years depending on the SFWMD priorities and availability of funds. The goals and objectives of the Research Plan have been defined to maintain the critical linkage between research and the requirements of water management and legislative mandate. Research strategies for the South IRL are summarized below and projects are listed in Table 6-9.

Table 6-9. Projects for Establishing Optimum Freshwater Inflows to the SIRL

Project Title	Reference
Indian River Lagoon Seagrass Mapping	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/irl_seagrass.html
South Indian River Lagoon Seagrass Transects	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/irl_seagrass_trans.html#top
Water Quality targets for the South IRL	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/irl_wq_targets.html
Laboratory Studies of the Salinity Tolerance of SAV	http://www.sfwmd.gov/or/wrp/wrp_ce/projects/gumbo_limbo_mesocosm.html
Laboratory Studies of the Salinity & Substrate Tolerance of Oysters	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/oyster_program.html
St. Lucie Estuary Hydrodynamic/Salinity Model	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_salinity_model.html
St. Lucie Estuary Water Quality Model	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_wq_model.html
Upper East Coast (UEC) Watershed Model	http://www.sfwmd.gov/org/wrp/wrp_ce/
UEC Citrus Best Management Practices (BMPs)	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/uec_bmp.html
IRL–South Project Management Plan Studies	http://www.sfwmd.gov/org/wrp/wrp_ce/
St. Lucie River Minimum Flows and Levels	http://www.sfwmd.gov/org/wsd/mfl/stlmfl/index.html
Fort Pierce Inlet Area Indian River Lagoon Hydrodynamics and Salinity Model	http://www.sfwmd.gov/org/wrp/wrp_ce/projects/irl_hydro_pres.html

Estuaries depend on freshwater input not only for their existence, but also because fresh water influences the biological structure (composition, abundance, and distribution of flora and fauna) and ecosystem function (physical, chemical, and biological processing of material). Despite years of effort, questions of how much fresh water and what water quality are required to maintain a naturally functioning estuary remain at the forefront of basic estuarine research.

One purpose of research efforts that are underway to determine freshwater inflows that are needed to protect and enhance key estuarine communities, is to provide information and performance criteria required to fulfill the mandates of SWIM, MFLs, PLRGs, and potential TMDLs. The Florida Watershed Restoration Act (1999) establishes FDEP as the lead agency for TMDL development. This Act requires the SFWMD to support and coordinate in the development of these pollution abatement goals. On-going research and analyses, by the SFWMD, for the development of pollution load reduction goals (PLRG) provides an opportunity for consistent input into the TMDL process. The schedule and process for TMDL development the northern portion of the Indian River Lagoon (TMDL Group 5) differs from the schedule and process used for the southern portion of the lagoon. The St. Lucie Estuary is in Group 2 and follows a more accelerated schedule that requires completion of the Verified List by 2003.

Additional detail on the TMDL process and the relationship to PLRG development can be found in the Appendix A of this Plan

Another application of these research efforts is to assess the impact of the CERP components and facilities, in order to help determine proper operational guidelines, which meet environmental goals as shown in Figure 6-9. Successful operation of new CERP infrastructure will be critical to achieving environmental restoration goals and targets.

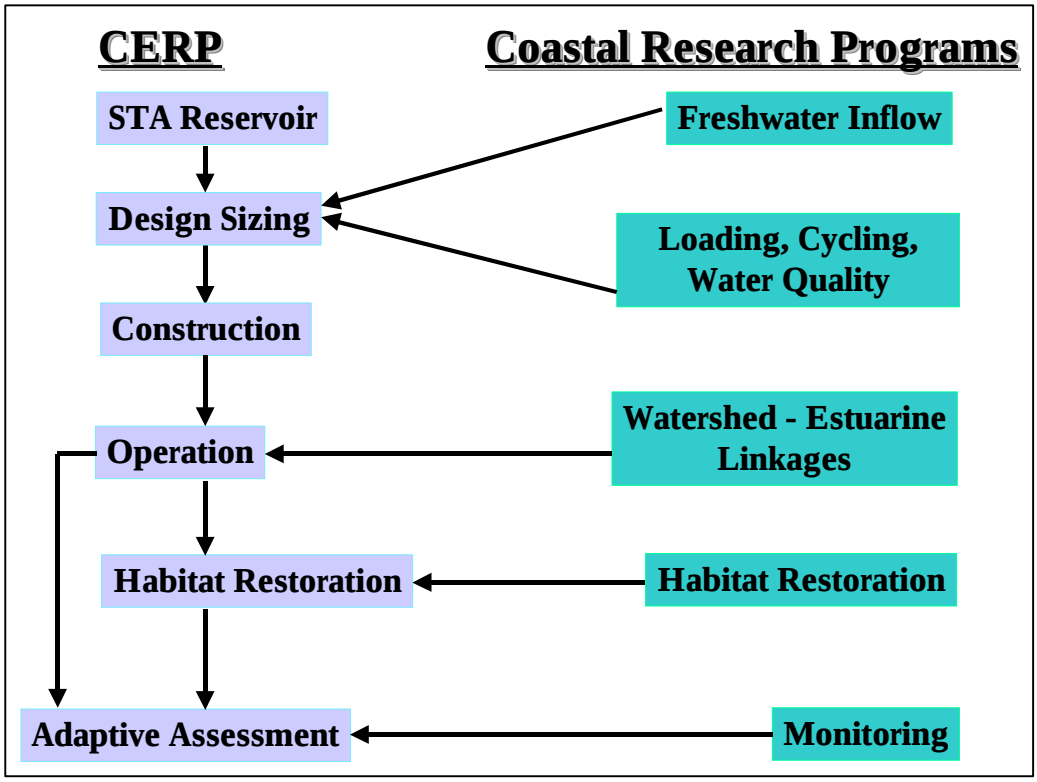

Figure 6-9. Coordination and Integration of Coastal Research and CERP.

Central to successful operation is the environmentally compatible delivery of freshwater to downstream estuarine and marine systems. Little information currently exists in the literature regarding how to best deliver freshwater to an estuary. Therefore, additional experimental and monitoring studies are required.

Land Acquisition.

Significant land acquisition has occurred in the South IRL watershed in recent years. Public acquisition of lands is important to protect or restore wetlands, tidal systems, and uplands, but it can also be quite effective in mitigating pollutant loads – present and future. The SFWMD has partnered with state, federal, and local governments to acquire properties for preservation, restoration, and stormwater treatment systems. Both Martin and St. Lucie Counties have held successful referendums to raise funds for public acquisition of environmentally sensitive lands.

Additional Information on Land Acquisition Projects is available from the following websites:

Martin County - Capital Projects Updates
http://www.martin.fl.us/GOVT/depts/adm/cie/status_reports/04.02.02.html

Martin County - Healthy Rivers
http://www.martin.fl.us/GOVT/depts/adm/rivers/
http://www.martin.fl.us/GOVT/depts/adm/rivers/onecent/March.2002.html

St. Lucie County - Environmental Lands Program
http://co.st-lucie.fl.us/esl/index.htm

Watershed Land Acquisition - Preservation/Restoration
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/maps/uec_plate2.pdf

The IRL - South Plan (USACOE and SFWMD) proposes to acquire approximately 116,000 acres, with almost 93,000 acres devoted to natural storage and water quality treatment areas. These areas will be restored by plugging existing drainage systems to retain rainfall onsite, while providing groundwater recharge, re-hydration of historic wetlands, enhancement of existing wetlands, and improved wetland and upland habitat for native wildlife, including, but not limited to, threatened and endangered species

The SFWMD and Martin County have partnered to purchase several large properties, i.e., Atlantic Ridge and Allapattah Ranch. In addition, the SFWMD and local governments have cost shared land acquisition for smaller stormwater improvement projects. For specific information on land acquisition associated with the IRL *Blueway* program, mosquito impoundments, coastal or barrier island habitat restoration, see the Coastal Wetlands Section.

Coordination with Other Agency Plans.

Various SFWMD work groups and the Martin/St. Lucie (MSL) Service Center have extensive coordination and regular communication with the IRL NEP, FDEP, FDACS, SJRWMD, as well as a number of Federal agencies, USACE, USGS, USFWS, etc. Likewise, the MSL Service Center works closely with the local governments and stormwater utilities in St. Lucie and Martin Counties. Updates and coordination associated with SWIM, the UEC Water Supply Plan, UEC BMPs, PLRGs and potential TMDLs, also require that the SFWMD work closely with various agencies. See Figures 6-4 and 6-5 as examples of projects with ongoing agency and stakeholder interaction. Coordination activities are summarized in Table 6-10.

The St. Lucie River Issues Team program provides additional opportunities for consistent coordination and communication through their annual evaluation of projects and quarterly progress reports and coordination. The FDEP Port St. Lucie Regional Office Director and the Director of the SFWMD Martin/St. Lucie Service Center meet on a regular basis and co-chair the St. Lucie River Issues Team. Recently, the University of Florida, IFAS, Indian River Research and Education Center coordinated a Research Forum which allowed the Indian River Citrus BMP Working Group and the St. Lucie Issues Team to present information on the status of current projects for agencies stakeholders and the public. It is anticipated that this will be on annual event to provide information and coordinate project planning and development in the South IRL/SLE Watershed. Finally, Development of the IRL - South Feasibility Study required extensive interaction among local, state and Federal agencies and the various stakeholders in the watershed, and this will continue as the project moves forward.

Table 6-10. Coordination with Other Agency Plans.

PROJECT NAME	DESCRIPTION	STATUS	LEAD AGENCY
Martin/St. Lucie Service Center (1995)	Service Center was established and opened in the fall of 1995 in Stuart to provide coordination and communication with the National Estuary program, local government planning efforts and local interests	Continuing	SFWMD
Draft IRL Feasibility Study & EIS	Awaiting final revisions before submission to Congress 2002	In Progress	SFWMD
IRL - South Project Management Plan (PMP)	Document under construction for submission to USACOE in 2002	In progress	SFWMD
Voluntary Agricultural and Urban Best Management Practices (BMPs)	Several on-going efforts are in progress to implement BMPs in the SIRL Watershed. Partner ships involve a variety of organizations.	Continuing	UF, IFAS, IRREC, Ft. Pierce/St. Lucie River Initiative, Stuart
St. Lucie River Issue Team	Continuing cooperative program involving local stormwater improvement projects, research and education, FDEP, SFWMD, local governments, federal agencies, Florida Universities, state agencies, NGO's, and the private sector.	Continuing	FDEP/SFWMD
2002 Indian River Citrus BMP/St. Lucie River Issue Team Research Forum	One day forum for agencies, researchers, and stake-holders interested in on-going research projects in the SIRL watershed. This may become an annual event.	Completed	UF, IFAS, IRREC, Ft. Pierce/St. Lucie Issues Team

Indian River Lagoon – South Feasibility Study

The Indian River Lagoon-South Feasibility Study identifies a recommended plan that, when implemented, will help restore, protect, enhance, and preserve the South Indian River Lagoon and the St. Lucie Estuary and River. The IRL-South Plan provides an opportunity to reverse the course of declining ecosystem health and restore a highly productive system. The reconnaissance and feasibility phases of the Restudy demonstrated that the Indian River Lagoon is an integral part of the Comprehensive Everglades Restoration Plan (CERP). The Indian River Lagoon – South Feasibility Study is a continuation of the Restudy, with a purpose to further develop the conceptual designs of CERP components within Martin and St. Lucie counties. Hydrologic modeling, environmental modeling, water quality analyses, and water supply studies were conducted to refine the information developed in CERP. The IRL–South Plan reduces the impacts from the watershed runoff while relying on the development of other CERP components which significantly reduce the number and frequency of high volume discharges from Lake Okeechobee through C-44 canal to the estuarine system. Acquisition of land is an important aspect of this plan as shown in Figure 6-10.

Major Features of the Recommended Plan

Above Ground Water Storage

Four above-ground water reservoirs will be constructed to provide 127,150 acre-feet of storage. Construction of these features includes water control structures, pumps, levees, canals and the acquisition of approximately 13,196 acres of land in Martin and St. Lucie counties. The reservoirs would have a maximum storage elevation of 8 feet for the C-25 reservoir, 10 feet for the C-44 reservoir and 12 feet for the C23/24 reservoirs. These facilities would be designed to:

1. Provide storage for watershed runoff from C-44, C-23, C-24; and C-25 canals;
2. Reduce extreme high peaks of watershed discharges into the receiving water bodies;
3. Provide reduction in phosphorus load (3%) and in nitrogen load (3%) to the St. Lucie River and Estuary and to the South Indian River Lagoon; and,
4. Provide water supply for agriculture to offset reliance on the Floridan Aquifer from 27 years in 30 to 10 years in 30.

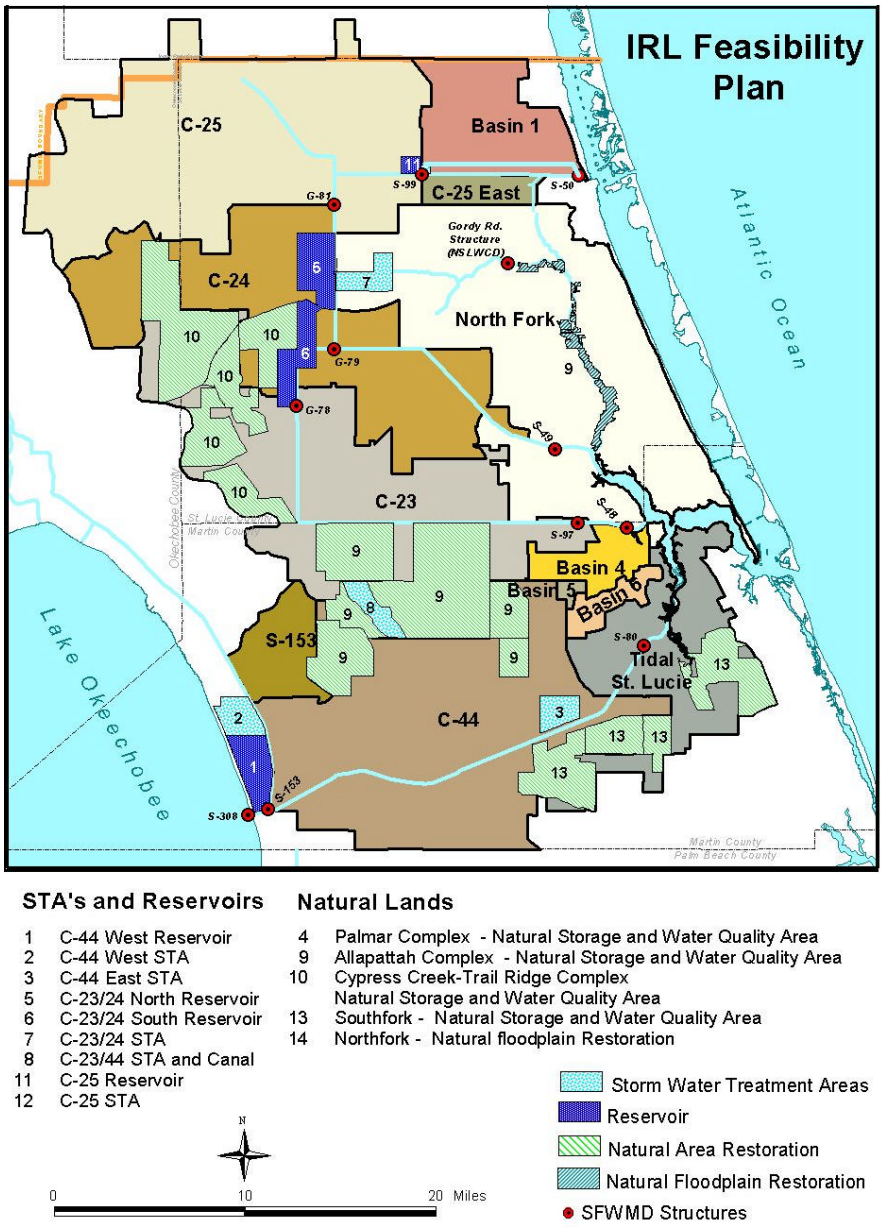

Figure 6-10. IRL South Plan Proposed Land Acquisition Components

Stormwater Treatment Areas

Five storm water treatment areas would be constructed to provide phosphorus reduction (18%) and nitrogen reduction (8%) to the St. Lucie River and Estuary and the South Indian River Lagoon. Construction of these features includes canals, levees, water control structures, pumps, and acquisition of 9,939 acres of land (7,639 acres of intense agriculture and 2,300 acres of highly impacted pastureland). Facilities would have a maximum water depth of 4 feet and a normal operating depth of 18 to 24 inches. and would be designed to provide water quality treatment to watershed flows captured prior to release to the St. Lucie River and Estuary, the South Indian River Lagoon and Lake Okeechobee.

Natural Storage and Water Quality Treatment Areas

Natural Storage and Water Quality Treatment Areas include the following: acquisition of 92,919 acres of upland/wetland mosaic, plugging of existing secondary drainage ditches to remove discharge into C&SF system canals, a total effective storage capacity of approximately 30,000 acre-feet, and phosphorus reduction (6%) and nitrogen reduction (4%) to the St. Lucie River and Estuary and South Indian River Lagoon. This is a multi-purpose feature designed to capture watershed flows prior to runoff into primary and secondary canal systems of the upper East Coast region. This is accomplished by plugging the existing drainage system of these

92,919 acres to retain rainfall onsite while providing groundwater recharge, re-hydration of historic wetlands, and enhancement of existing impacted wetlands.

Diversion of Existing Watershed Flows

An operational constraint of the recommended plan involves two different diversion goals: 1) Diversion of C-23 & C-24 discharges into the North Fork of the St. Lucie River as opposed to their current discharge points near the middle estuary; and, 2) Diversion of C-23 flows to the C-44 canal where they will be directed to either the South Fork of the St. Lucie River or Lake Okeechobee. About 105,000 acre-feet per year of canal flows are diverted due to this component. Approximately 64,000 acre-feet per year, which previously discharged through C-23 and C-24, will now discharge to the North Fork via Ten-Mile Creek. Approximately 41,000 acre-feet per year will discharge into Lake Okeechobee that previously discharged from C-23 and C-24 to the St. Lucie River and Estuary.

Muck Remediation and Artificial Habitat

Muck component to remove 5,500,000 cubic yards of muck from a total of four 'hot spots' located in the North Fork, South Fork, and Middle Estuary of the St. Lucie River. Removal of this muck provides approximately 1,200 acres of new suitable substrate for bottom organisms to recolonize. In addition, artificial habitat materials are being placed into the river and estuary in the general location of the muck remediation in an effort to speed up this process of oyster reef formation. An additional 90 acres of habitat will be created by use of oyster shell, artificial reef balls, and artificial submerged aquatic vegetation.

What the Plan Will Accomplish

Implementation of the Indian River Lagoon – South Plan will begin the recovery process of the St. Lucie River and Estuary and the South Indian River Lagoon. The Plan meets the following objectives: 1) Enhances ecological values by improvements to the estuarine health of the St. Lucie River and Estuary and the South Indian River Lagoon through a reduction of damaging discharges to the receiving water bodies, retention of water in the natural system, water quality treatment of captured water, and restoration of historic natural wetland-upland mosaic systems thereby preserving, protecting, increasing the spatial extent and enhancing wetlands areas outside the Everglades; and 2) Enhance economic values and social well being by increasing water supply, maintaining flood control, and improving economic opportunities through restoration of the natural resource by reducing the existing unacceptable level of flocculent ooze and muck in the estuarine system and by significantly reducing the source of that ooze and muck.

How the Plan Will Be Implemented

A draft of the overall implementation schedule for this project is provided in Table 6-11. A Project Management Plan (PMP) for the recommended plan is currently under development and

Table 6-11. Draft Implementation Schedule for IRL-S, from 15 June 2002 to 23 December 2010 (Subject to COE & SFWMD Approval v.5, 18 Mar 2002)

Project/Component	Duration	Start	Finish
Indian River Lagoon South (overall)		15-Jun-02	23-Dec-10
Project Management Plan (PMP) Development	**212 days**	**9-Oct-01**	**31-Jul-02**
C-44 Basin Components			
C-44 West Reservoir & STA			
Real Estate Acquisition	780 days	15-Jun-02	27-May-05
Preconstruction Engineering and Design	780 days	15-Jun-02	27-May-05
Construction (phased)	780 days	1-Nov-04	26-Oct-07
C-44 East STA			
Real Estate Acquisition	780 days	1-Jan-03	27-Dec-05
Preconstruction Engineering and Design	780 days	1-Jan-03	27-Dec-05
Construction	720 days	28-Dec-05	30-Sep-08
PMP Development	**212 days**	**9-Oct-01**	**31-Jul-02**
C-23/24/ Basin Components			
C-23/24 North Reservoir			
Real Estate Acquisition	780 days	15-Jun-02	27-May-05
Preconstruction Engineering and Design	780 days	15-Jun-02	27-May-05
Construction	780 days	30-May-05	23-May-08
C-23/24 South Reservoir			
Real Estate Acquisition	780 days	15-Jun-02	27-May-05
Preconstruction Engineering and Design	780 days	15-Jun-02	27-May-05
Construction	780 days	30-May-05	23-May-08
C-23/24 STA			
Real Estate Acquisition	780 days	15-Jun-02	27-May-05
PED	780 days	15-Jun-02	27-May-05
Construction	780 days	30-May-05	23-May-08
C-23/44 STA & Canal			
Real Estate Acquisition	780 days	1-Oct-03	26-Sep-06
Preconstruction Engineering and Design	780 days	1-Oct-03	26-Sep-06
Construction	780 days	27-Sep-06	22-Sep-09
PMP Development	**212 days**	**9-Oct-01**	**31-Jul-02**
C-25 North Fork & South Fork Basin Components			
C-25 Reservoir/ STA			
Real Estate Acquisition	780 days	1-Jul-04	27-Jun-07
Preconstruction Engineering and Design	910 days	1-Jul-04	26-Dec-07
Construction	780 days	27-Dec-07	22-Dec-10
Natural Storage Area & Water Quality			
Real Estate Acquisition - Allapattah	1040 days	15-Jun-02	26-May-06
Real Estate Acquisition PalMar	1040 days	1-Jan-03	26-Dec-06
Real Estate Acquisition Cypress Creek/Trail Ridge	1040 days	1-Jan-03	26-Dec-06
Preconstruction Engineering and Design	1040 days	1-Jan-03	26-Dec-06
Construction	1040 days	27-Dec-06	21-Dec-10
Muck Removal & Artificial Habitat			
Real Estate Acquisition	650 days	1-Jul-05	27-Dec-07
Preconstruction Engineering and Design	650 days	1-Jul-05	27-Dec-07
Construction	780 days	28-Dec-07	23-Dec-10
Natural Floodplain Restoration			
Real Estate Acquisition	390 days	1-Oct-03	29-Mar-05
Preconstruction Engineering and Design	650 days	1-Oct-03	28-Mar-06
Construction	520 days	29-Mar-06	25-Mar-08
PMP Development	**212 days**	**9-Oct-01**	**31-Jul-02**

will be available with the release of the final report. The plan will identify specific tasks to be accomplished during pre-construction engineering and design.

A follow-on Special Project Implementation Report (SPIR) will be completed to address the water reservations issues associated with the Indian River Lagoon – South Plan as required by the Water Resources Development Act of 2000 and Section 373.470, Florida Statutes.

A separate feasibility study effort is ongoing to investigate the northern portions of the Indian River Lagoon. That feasibility study will investigate water resource problems in Brevard, Volusia, and Indian River counties associated with the existing C&SF Project system. A multi-agency, interdisciplinary team has been formed to perform this study. The local sponsor is the St. Johns River Water Management District.

The Next Five Years

Seagrass and Water Quality

- Continue mapping every 2 years, collecting aerial photography each year, lagoon wide transects twice a year, and seagrass/algae monitoring near St. Lucie Inlet each month
- Continue in-lagoon water quality monitoring as modified in 2000.
- Incorporate all historic data, for future seagrass change analysis and targets.
- Refine and evaluate bathymetric coverage to rectified 2001 imagery.
- Continue to evaluate the water quality/seagrass link to support PLRG development.
- Continue to work with local partners help fund land acquisition and habitat restoration.
- Continue coordination and joint projects with the SJRWMD and IRLNEP.

Pollution Load Reduction Strategies

- Complete Moore's Creek Retrofit Project, and fully implement voluntary BMPs in the C-25/Ft. Pierce Farms Basin.
- Completion of Taylor Creek Muck Removal Project.
- Replacement of Indian River Drive stormwater outfall pipes in St. Lucie County.
- Continue to install baffle boxes in Sewalls Point and other sites that discharge stormwater directly to the lagoon.
- Initiation of the Manatee Creek Basin Retrofit Project in Martin County.
- Continue support for implementation of voluntary BMPs through the Indian River Citrus League, and the St. Lucie River Initiative.
- Employ sound solutions that further reduce WWTP discharges and wet weather effluent discharges from other sources.

Monitoring, Modeling and Applied Studies

- Add one additional lagoon tidal station in segment 24.
- Implement atmospheric deposition monitoring in lagoon sub-basins.
- Continue studies on Submerged Aquatic Vegetation (SAV) and other Valued Ecosystem Component (VEC) at the Gumbo-Limbo Mesocosm Laboratory.
- Continue studies on muck removal and disposal technology.
- Continue to support existing local government surface water monitoring projects in tributaries that discharge to the lagoon.
- Continue to support the annual Indian River Citrus BMP/St. Lucie River Issues Team Research Forum.
- Complete development, validation, and calibration of the Watershed Water Quality Model, WaSh, and the St. Lucie Estuary Water Quality Model.

- Continue refining South IRL water quality targets and have PLRG adopted by 2006.
- Implement a "State of the Watershed - 2004" conference that will provide benchmarks to evaluate success of non-point pollution abatement efforts and identify unmet needs.

Coordination with Other Planning Efforts

- Continue implementation of the IRL-South Plan
- Continue to communicate and coordinate with FDEP, other agencies, and stakeholders in PLRG establishment, and any future TMDL activities.
- Continue support and coordination with the St. River Issues Team.
- Continue support and coordination with local governments and other partners.

Coastal Wetlands

Project Descriptions and Status

The South IRL contains a variety of salt marsh wetlands, mangrove swamp, and tidal creeks. Approximately 5000 acres of impounded marshes were used for mosquito control. A SWIM priority is to reconnect these impounded areas to the South IRL. Incorporating operational changes and enhanced mosquito control management practices, such as, flow through strategies designed to increase circulation during summer mosquito control phases, have resulted in improved water quality and bio-diversity. Implementation of integrated pest management programs by mosquito control districts has also allowed for reductions in pesticide application rates in the coastal wetlands adjacent to the IRL. Another SWIM priority is shoreline habitat preservation and restoration. These two priorities are key elements of the SFWMD coastal wetlands program (see Figure 6-11). Major projects are listed in Table 6-12.

Table 6-12. Description and Status of Coastal Wetlands Projects

PROJECT NAME	DESCRIPTION	STATUS	LEAD AGENCY
Indian River Lagoon Mangrove Restoration	Cooperative multi-agency effort to reestablish mangroves and test various planting methods. (see http://www.elcweb.org/shoreline/index.html)	In progress	Environmental Learning Center (ELC) Vero Beach
Indian River Lagoon Wetland Restoration	Re-establish coastal marshes and wetlands in accordance with *Blueway* Plan.	Continuing	Martin and St. Lucie counties
Mosquito Impoundment Report	Progress report on mosquito impoundment activities	Completed	St. Lucie County Mosquito Control District
Mosquito Control Impoundment Reconnects	St. Lucie and Martin counties have plans to reconnect all mosquito impoundments	In progress	St. Lucie & Martin County Mosquito Control District
Mosquito Impoundment Restoration	Habitat restoration and exotic removal within recommended impoundments is well underway.	Continuing	St. Lucie & Martin County Mosquito Control
Indian Riverside Park Restoration	Exotic Removal and reconnection of tidal marsh to the IRL.	Completed	Martin County
1996-2001 Snook License Plate Projects	Multiple projects for stormwater retrofits, habitat restoration, exotic removal, environmental education.	In progress	Multiple agencies/ non-profit
2002-2003 Snook License Plate Projects	Projects covering habitat restoration, exotic removal.	In progress	Multi-agency and non-profits
TNC Blowing Rocks Shoreline Restoration	Long-term program for exotic removal and shoreline vegetation restoration.	In progress	Nature Conservancy @ Blowing Rocks, Martin Cty

Reconnection of mosquito impoundments has been relatively successful in the South IRL (see Figure 11). St. Lucie Mosquito Control District has an extensive impoundment retrofit program. Typical projects involve breaching dikes, installing culverts, installing pumps and other water control devices. Each of these projects also has a habitat restoration element that includes exotic vegetation removal and restoration of native vegetation. The St. Lucie County Mosquito Control District has also successfully implemented a Land Acquisition Preservation Program,

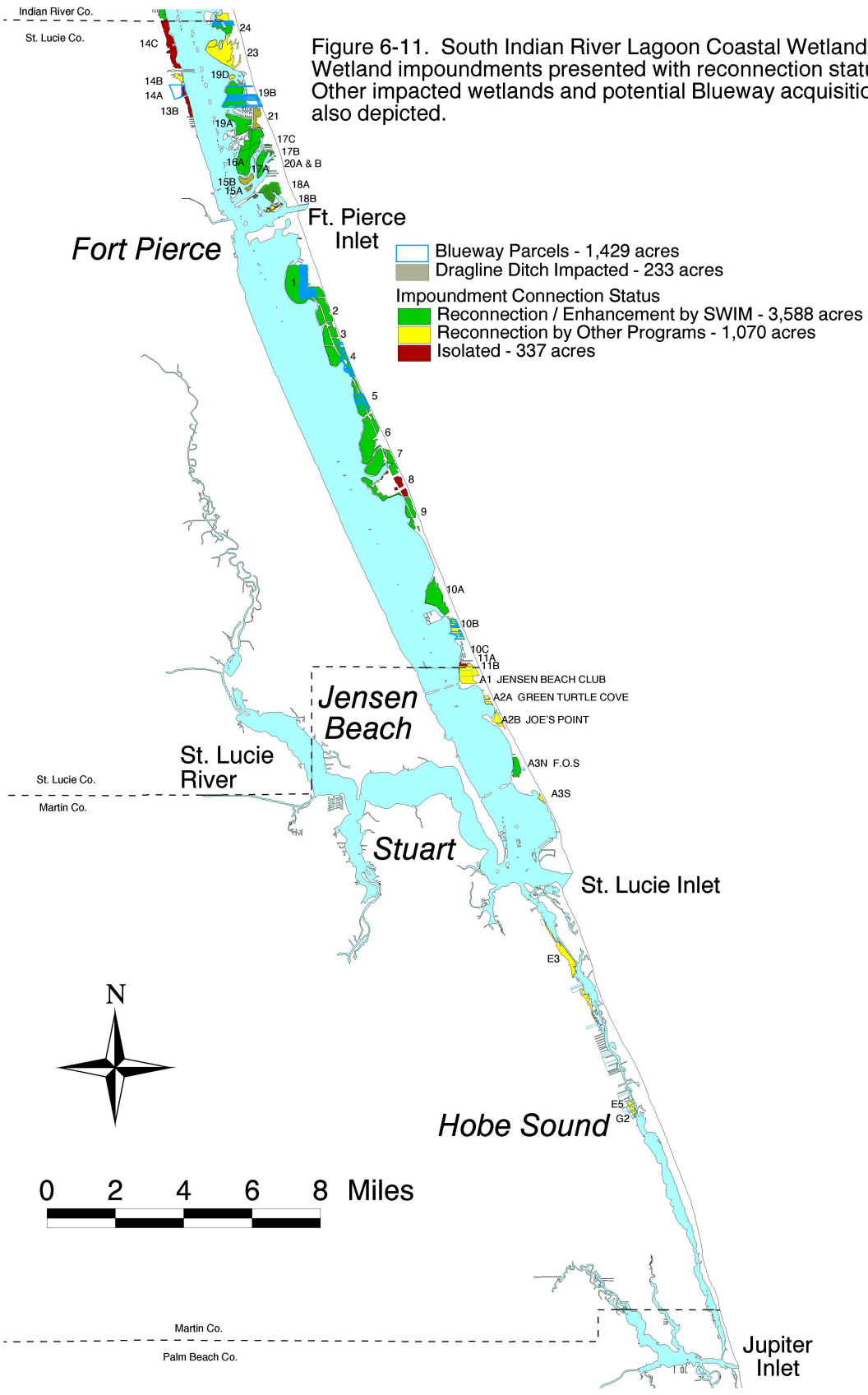

Figure 6-11. South Indian River Lagoon Coastal Wetlands. Wetland impoundments presented with reconnection status. Other impacted wetlands and potential Blueway acquisitions also depicted.

with over 55% of the coastal barrier island in St. Lucie County now under public ownership. The land acquisition/ mitigation/ donation program is a critical component of the Mosquito District's coastal impoundment management program. In 1999, St, Lucie County acquired 33 acres on the west shore of the lagoon that is currently undergoing habitat restoration.

Martin County Mosquito Control has an active program of mosquito impoundment rehabilitation. In 2001 Martin County Mosquito Control received a $50,000 grant from SFWMD (SWIM) to add more culverts and an electric pump station to the Florida Oceanographic Society Impoundment. This was a first step in a Martin County Conservation Area, restoration project involving almost 40 acres of estuarine habitat. In addition, about 500 acres of Hutchinson Island owned by Martin County. A wetland mitigation bank is also in the permitting process. Both counties have focused on improving water quality in impoundments, and the use of impoundments by wading birds, fishes, etc., to increase the productivity and biodiversity of the South IRL ecosystem. In addition, there has been progress on other shoreline habitat preservation and restoration efforts. In Palm Beach County work was completed to remove exotics and restore tidal creeks and ponds, mangrove swamp and hydric hammock habitat.

The Nature Conservancy (TNC) owns and manages the 73-acre coastal Blowing Rocks Preserve, located on southern Jupiter Island in Martin County. The preserve has over a mile of shoreline on the South IRL. Approximately 46 acres of mangrove swamp and adjoining uplands adjacent to the lagoon is slated for restoration or enhancement. The preserve has developed a 5-year restoration plan and has completed projects on some units. Future restoration and maintenance of segments will occur as funding becomes available.

Martin County recently opened Indian Riverside Park on the west side of the lagoon, and in addition to exotic removal a portion of the park now includes a restored tidal mangrove area. The Florida Inland Navigation District (FIND) also owns property a long the South IRL, which is designated primarily for spoil disposal but may also offer opportunities for shoreline restoration and water quality improvement. Other coastal habitat restoration and exotic removal projects involve FDEP at the Ft. Pierce Inlet State Park, St. Lucie Inlet Preserve State Park, Seabranch Preserve State Park, and efforts of the IRL Spoil Island Working Group. The Jupiter Inlet site in Palm Beach County also has habitat restoration potential.

The Hobe Sound National Wildlife Refuge consists of two separate tracts of land totaling over 1000 acres. The 735 acre Jupiter Island tract adjacent St. Lucie Inlet Preserve State Park, (4,834 acres) and the approximately 300 acre sand pine scrub mainland tract, to the south. The refuge is presently completing Comprehensive Conservation Plan (CCP). This plan will address the future need for visitor services and long term protection of the resources.

Mangrove restoration has been an ongoing cooperative effort. An experimental planting program has been underway for several years throughout the South IRL, using PVC pipe to stabilize mangrove seedlings (see http://www.elcweb.org/shoreline/index.html). Results indicate that sites must be carefully selected and seeds must be planted at proper water depths to ensure success.

Funding for coastal wetlands projects is a constant challenge, especially in regards to land acquisition. IRL license tag funds, St. Lucie Issues Team funds, and a variety of grants have been successfully used by local governments, state agencies to undertake projects. Future *Blueway* acquisitions have also been identified and some progress may occur over the next five years as state funding becomes available to allow the counties to move forward.

The Next Five Years

Rehabilitation of Impounded Wetlands

- Fully reconnect all mosquito impoundments in the South IRL.
- Use various funding sources to restore habitats in reconnected impoundments.
- Use of various funding sources to provide for research and monitoring of fisheries and wildlife utilization of restored mosquito impoundments.

Spoil Island Rehabilitation

- Continue coordination with FDEP and others to implement habitat restoration projects.

Shoreline Restoration

- Continue to support exotic removal and habitat restoration projects.
- Utilize a variety of funding sources to maximize shoreline restoration.

Preservation of Coastal Habitat - Land Acquisition

- Support *Blueways*, and other lagoon land acquisition, through cost shared funding.

Cooperative Mangrove Planting

- Continue to support encased planting method as appropriate, and explore other alternatives in high wave energy areas.

Web Site References for South IRL and St. Lucie Estuary

Environmental Learning Center - Shoreline Restoration
http://www.elcweb.org/shoreline/index.html

FDEP Sites - Aquatic Preserves

http://www.dep.state.fl.us/coastal/sites/indianriver/

FDEP Sites - Stormwater & TMDLs
http://www.dep.state.fl.us/water/tmdl/index.htm
http://www.dep.state.fl.us/water/stormwater/index.htm

FDEP Site - Water Quality
http://www.dep.state.fl.us/water/monitoring/index.htm

FDEP Site - Watersheds
http://www.dep.state.fl.us/water/watersheds/index.htm

FDEP Site - Surface Water
http://www.dep.state.fl.us/water/surfacewater/index.htm

FDEP Site - Water policy
http://www.dep.state.fl.us/water/waterpolicy/index.htm

Florida Oceanographic Society
http://www.fosusa.org/water.htm

Martin County - Overview
http://www.martin.fl.us/GOVT/depts/adm/annual_report_2001.pdf

Martin County - Capital Projects Updates
http://www.martin.fl.us/GOVT/depts/adm/cie/status_reports/04.02.02.html
http://www.martin.fl.us/GOVT/depts/adm/rivers/
http://www.martin.fl.us/GOVT/depts/adm/rivers/onecent/March.2002.html

Martin County - Stormwater
http://www.martin.fl.us/GOVT/docs.html

Port St. Lucie - Sewer System Master Plan
http://www.cityofpsl.com/CityHall/Water_sewer_expansion.htm

St. Lucie County - Stormwater
http://www.stlucieco.gov/engineering/stormwater/index.htm

Indian River Estates Subdivision Stormwater Project
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/savanna.html

St. Lucie County - Environmental Lands Program
http://co.st-lucie.fl.us/esl/index.htm

SJRWMD - IRLNEP
http://sjr.state.fl.us/programs/index.html

SFWMD - MSL Service Center - St. Lucie Issues Team
http://www.sfwmd.gov/org/exo/mslsc/slr/sle_issues_team.html
http://www.sfwmd.gov/org/exo/mslsc/wtrsp/index.html

SFWMD - MSL Service Center - Know The Flow
http://www.sfwmd.gov/org/reg/know_flow.html

SFWMD - UEC Water Supply Plan
http://www.sfwmd.gov/org/pld/proj/wsp/uecwsp.htm

SFWMD - Minimum Flows and Levels
http://www.sfwmd.gov/org/wsd/mfl/index.html
http://www.sfwmd.gov/org/wsd/mfl/stlmfl/index.html

SFWMD - IRL License Tag
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_lagoon/snook_tag.html

Variation in Primary Production and Benthic Nutrient Flux in the St. Lucie Estuary
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_benthic_flux.html

St. Lucie Estuary Water Quality Model
Ihttp://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_wq_model.html

St. Lucie Estuary Hydrodynamics/Salinity Model
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_salinity_model.html

SFWMD - In House Projects Muck Removal
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/muck.html

SLE Oyster Bed Restoration
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/oyster_program.html

SFWMD - South Indian River Lagoon Seagrass Studies
ftp://ftp.sfwmd.gov/pub/rbennet/docs/irl_sav_report.pdf

Artificial Habitats - SAV
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/artificial.html

St. Lucie Water Quality Data Collection
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/sle_wq_data_col.html

N. Fork Wetland Reconnection
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/oxbow.html

North Fork Nursery Study
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/n_fork_nursery.html

Upper East Coast Citrus Best Management Practices (BMPs)
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/uec_bmp.html
http://www.fcprac.ifas.ufl.edu/BMP/default.htm
http://www.irrec.ifas.ufl.edu/Bomanpdf/Citrus%20BMP%20Related%20Activities.htm

Ten Mile Creek Water Preserve Area Project
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/tenmile_creek.html

SFWMD - IRL - South Plan
http://www.sfwmd.gov

Watershed Land Acquisition - Preservation/Restoration
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/maps/uec_plate2.pdf

Restoration of Historic Upland/Wetland Habitat
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/irl_rfs.html

Enhancement/Restoration/Creation of Wetlands
http://www.sfwmd.gov/org/wrp/wrp_ce/projects/wetland.html

USACOE/SFWMD - IRL Feasibility Study
http://www.evergladesplan.org/pm/studies/irl/index.shtml

University of Florida, IFAS, Extension - Florida Yards and Neighborhoods
http://hort.ufl.edu/fyn/

University of Florida, IFAS, Extension - St. Lucie County
http://stlucie.ifas.ufl.edu/index.html

Peer Reviewed Publications
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/2_wrp_ce_pubs.html

Technical Publications & Reports
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/2_wrp_ce_docs.html

Other Documents
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/2_wrp_ce_outreach.html

Other Sources of Information
http://www.sfwmd.gov/org/wrp/intro_coastal_eco.html
http://www.sfwmd.gov/org/wrp/wrp_ce/2_wrp_ce_info/2_wrp_ce_links.html
http://www.sfwmd.gov/org/wrp/2_wrp_related.html
http://www.sfwmd.gov/org/wrp/2_wrp_glossary.html

References

Crean, D.J.; N. Iricanin; R.M. Robbins. 2001. Development of Water Quality Targets in the Southern Indian River Lagoon. South Florida Water Management District, West Palm Beach, FL.

Florida Center for Environmental Studies (FCES) 2002. Indian River Citrus BMP Implementation Committee Annual Report: 2000 - 2001. Florida Center for Environmental Studies. Palm Beach Gardens, FL

Florida Department of Environmental Protection (FDEP) 2001. St. Lucie and Loxahatchee: Basin Status Report: Draft. Florida Department of Environmental Protection. Division of Water Resource Management. Bureau of Watershed Management. Tallahassee FL.

Jue, S.; C. Kindell; and J. Wojcik. 2001. Florida Conservation Lands 2001. Florida Natural Areas Inventory. Tallahassee FL.

Robbins, R. and C. Conrad. 2001. Southern Indian River Lagoon Seagrass Change Analysis (1986 - 1999). Coastal Division. South Florida Water Management District.

South Florida Water Management District (SFWMD) 2001a. Discretionary Protocols for Lake Okeechobee Operations: Draft. 2001. Lake Okeechobee Division. Watershed Management Department.

SFWMD 2001b. Estuary Research Plan For the East and West Coast. 2001. Coastal Ecosystems Division. South Florida Water Management District, West Palm Beach FL.

SFWMD 2001c. Report on Martin/St. Lucie Service Center Activities. 1996-2001. South Florida Water Management District, West Palm Beach FL.

SFWMD 2001d. St. Lucie Issue Team 3-Year Report. 2001. Martin/St. Lucie Service Center. South Florida Water Management District. Stuart, FL

SFWMD 2002. Indian River Lagoon - South Feasibility Study: Fact Sheet. South Florida Water Management District, West Palm Beach FL.

U.S. Army Corps of Engineers (USACE) and SFWMD 2001a. Central and Southern Florida Project: Indian River Lagoon - South Feasibility Study. Draft: Integrated Feasibility Report: Supplemental Environmental Impact Statement. U.S. Army Corps of Engineers, Jacksonville FL District.

USACE and SFWMD 2001b. Central and Southern Florida Project: Indian River Lagoon - South Feasibility Study. Draft: Environmental Effects - Appendix E. U.S. Army Corps of Engineers: Jacksonville FL District and South Florida Water Management District, West Palm Beach FL.

University of Florida 2002. Indian River Citrus BMP/St. Lucie River Issue Team Research Forum: Presentation Summaries. University of Florida, Institute of Food and Agricultural Science (IFAS). Indian River Research and Education Center Fort Pierce, FL.

Woodward-Clyde Consultants, Marshall McCully & Associates, Natural Systems Analysts. 1994. Biological Resources of the Indian River Lagoon, Indian River Lagoon National Estuary Program Melbourne, FL. Final Report to Indian River Estuary Program.